UTILITIES AND OPENINGS FOR FUTURE UTILITIES IN BRIDGE

Utilities

Our policy regarding utility encroachments is covered in this memo. The designer should also consult the Department of Transportation's *Manual of Encroachment Permits* because casing requirements, etc., can dictate the size of openings. The applicable portions of that policy are attached to this memo. Variations and problems should be discussed with the Encroachment Engineer of the Office of Structures Maintenance and Investigations.

General

The District makes the fundamental decision to permit an encroachment in accordance with the Department of Transportation's *Manual of Encroachment Permits.*

The District submits the information on proposed encroachments on or near bridges to the Office of Structure Design.

During the design stage, the bridge designer reviews the proposal for the following:

1. Structural adequacy of the bridge for the weight and location of the facility.
2. Compliance with the "Encroachments on Bridges" section in the *Manual of Encroachment Permits.*
3. Conflicts in construction sequence.

The District and bridge designer should work in close conjunction with the District's Permit Engineer to avoid commitments that conflict with the encroachment policy. The bridge PS&E should clearly show the utility work to be performed by the State's Contractor.

The minimum information necessary on the plans consists of the name of the owner, general description, and the location of the facility, openings and access openings (if required). In addition, all hardware and material to be furnished and/or installed by the State's Contractor must be shown.

Transversely reinforced deck and soffit slabs supporting pipes or conduits shall be designed by the strength design method given in Article 8.16 of Caltrans *Bridge Design Specifications.*

If it becomes necessary to add utilities to a structure partially or completely designed, no change in the design need be considered unless the weight of the added utilities exceeds 10 percent of the combined weight of one of the girders and the slab carried thereon.

The District prepares the encroachment permits at the completion of the PS&E. Those involving bridges are submitted to the Office of Structures Maintenance and Investigations for approval. Upon approval, the District issues the permits.

Supersedes Memo to Designers 18-2 dated May 1989

During construction, inspection of the work is performed from the plans, specifications and the details of the permits.

Openings for Unanticipated Future Utilities

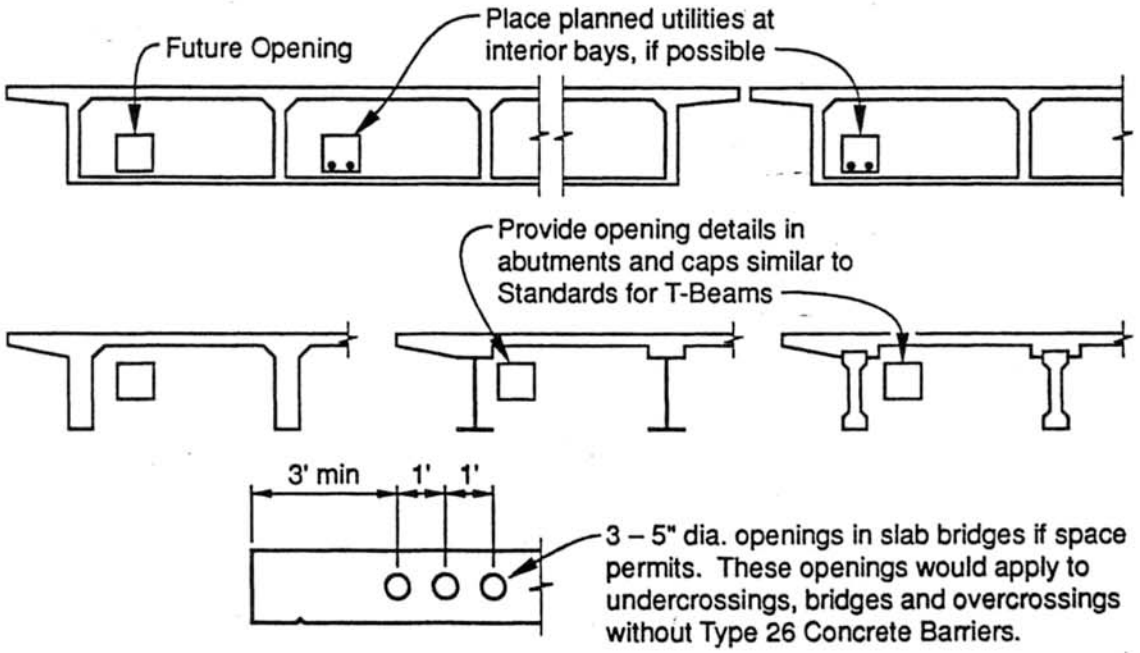
Designers are requested to make every effort to provide for future utilities. Requests are frequently made to carry utilities on completed bridges. These may include those belonging to others or State facilities such as irrigation lines and communication conduits.

Provisions should be made for unanticipated future utilities in all overcrossings and bridges over waterways. Future utility openings should be placed in the exterior bays at the outside of structures so that the utility can be placed under sidewalks or shoulders rather than within the traveled way. If the preferred locations are not available for structural reasons, provisions should be made to place openings at other locations.

Future utility openings should also be provided in undercrossings and other structures where this can be done easily. Exceptions to this policy might be: (1) ramp structures where it is unlikely that future utilities will ever be placed and (2) undercrossings with concrete approach slabs where future hookups would not be easy.

Openings should be provided in caps and diaphragms as per Standard Plans B6-10 and B7-10.

Provide for future utility openings in addition to any planned utilities. If this is not possible for structural reasons, consider enlarging the planned utility opening to accept future utilities.

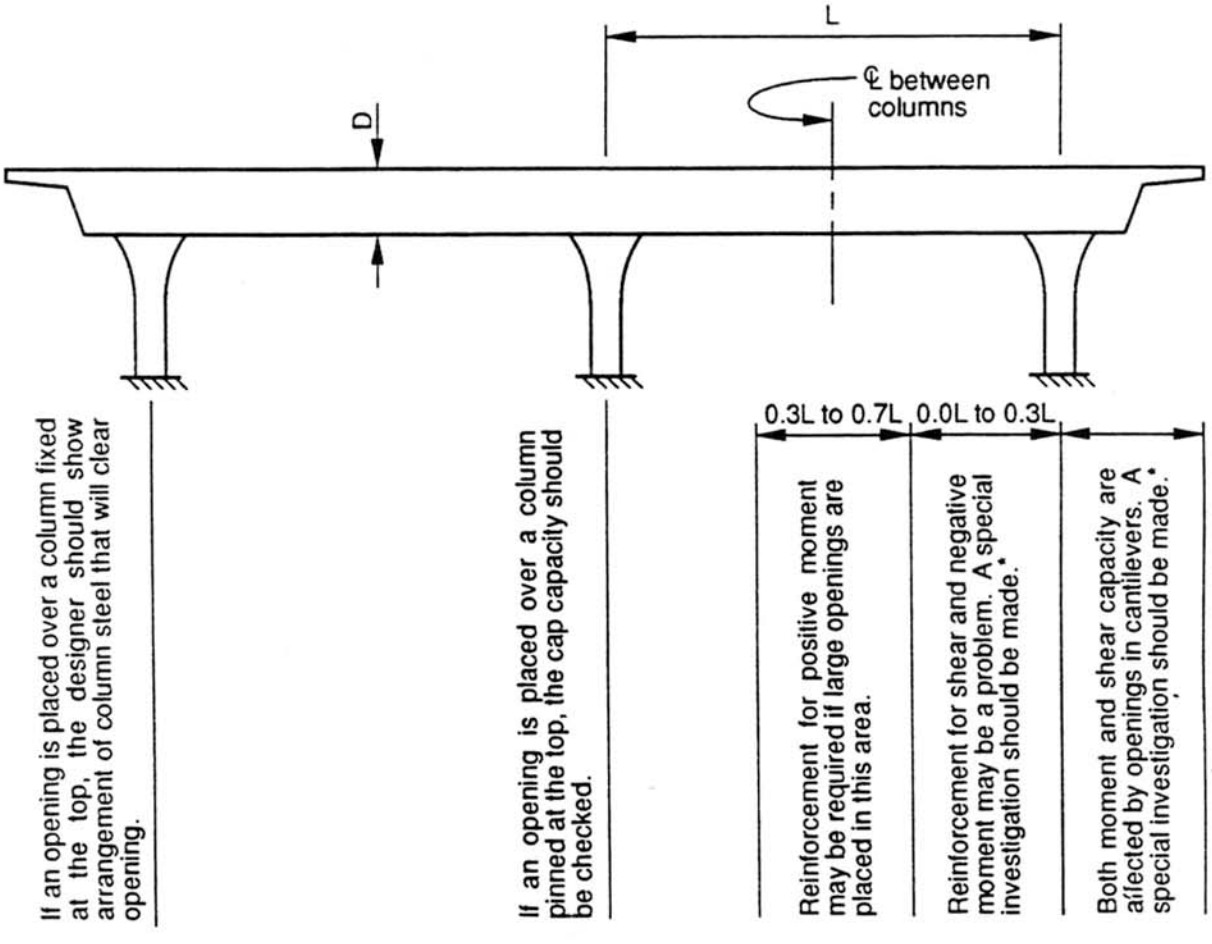


Typical Locations for Future Utilities
See Standard Plans B6-10, B7-10 for Sizing of Openings

Openings

The following comments apply to Standard Plans B6-10 and B7-10.

1. Openings which measure less than 0.5D (½ structure depth) for Reinforced Concrete Box Girders and T-Beams or 0.33D (⅓ structure depth) for Prestressed Box Girders do not usually require special investigation. Reinforcement on the "Utility Opening" sheets is sufficient.
2. Corner fillets are required for openings through bent caps. Check the width requirements of the utility and increase the width of openings at bent caps accordingly if the fillets conflict.
3. Openings which will be at or near the hinge or abutment bearing seat elevation should be investigated for conflicts between the opening and hinge or abutment reinforcement.
4. Openings through hinges with prestressing anchorages are not covered by the Standard Plans sheets.
5. Bent cap openings which measure larger than 0.5D for Reinforced Box Girders or 0.33D for Prestressed Box Girders should not be used unless thoroughly investigated, keeping the following points in mind:



*Shear capacity at openings should be checked. Shallow structure depths of prestressed structures and P-loads are two conditions which may require larger stirrups or closer spacing than designated on standard plan. Flared bottom slabs at bent caps may force the use of stirrups below the opening as well as above to provide capacity. When standard plan requirement is inadequate, detail required stirrups on contract plans.

Pay Quantities

There are two different conditions to consider:

1. Supports supplied by utility owners:

   Hangers, anchor bolt inserts, manhole frames and covers, sleeves, and other accessories required for utilities which must be cast in the concrete are usually furnished by the respective owners and are installed by the Contractor in accordance with details shown on the plans or as directed by the Engineer. Do not include the weights of items to be furnished by the utility and installed by the State's Contractor in the pay quantities for Miscellaneous Metal.

2. Supports to be supplied by the contractor:

   Weights of supports, cradles, hangers, etc., should be included in the pay quantities for Miscellaneous Metal.

Floyd L. Mellon

Guy D. Mancarti

RFB:jmm
Attachment

18-2 UTILITIES AND OPENINGS FOR FUTURE UTILITIES IN BRIDGE

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Memo converted to metric.

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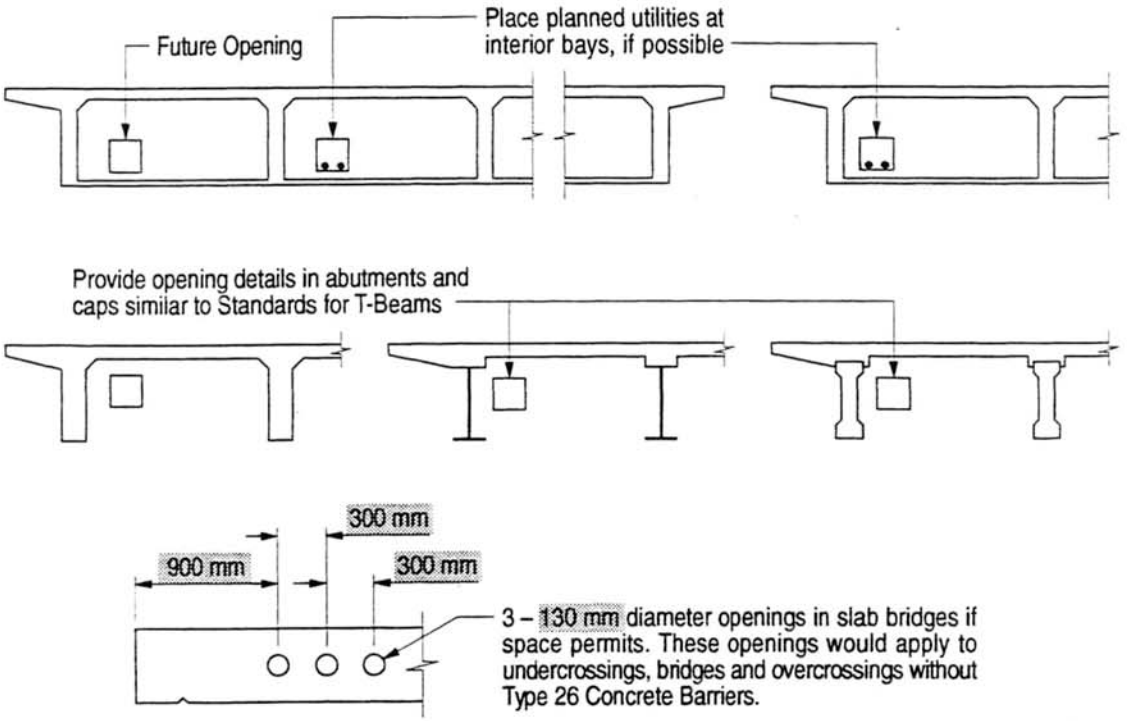

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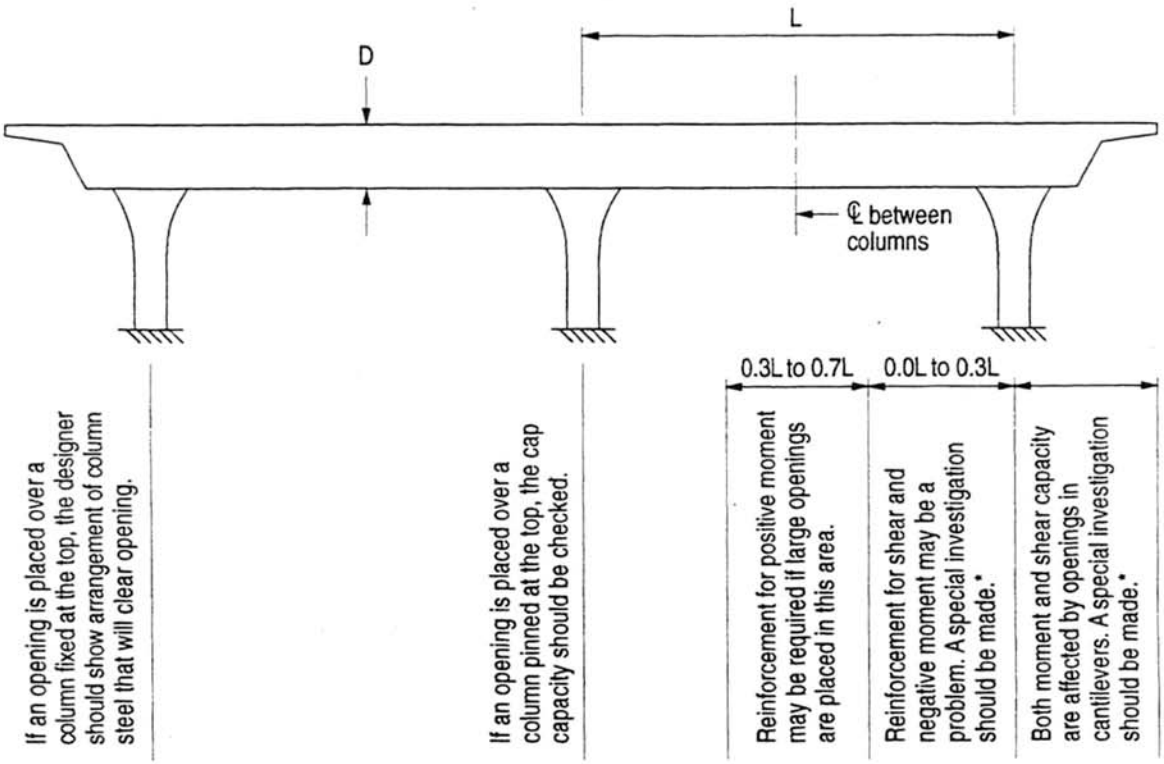

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Pay Quantities

There are two different conditions to consider:

1. Supports supplied by utility owners:

   Hangers, anchor bolt inserts, manhole frames and covers, sleeves, and other accessories required for utilities which must be cast in the concrete are usually furnished by the respective owners and are installed by the Contractor in accordance with details shown on the plans or as directed by the Engineer. Do not include the weights of items to be furnished by the utility and installed by the State's Contractor in the pay quantities for Miscellaneous Metal.

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   Weights of supports, cradles, hangers, etc., should be included in the pay quantities for Miscellaneous Metal.

Richard D. Land

Shannon H. Post

SDW:jgf/jlw

Attachment

Attachment

ENCROACHMENTS ON BRIDGES

Based on *Manual of Encroachment Permits*

All encroachments on bridges must be reviewed by the Office of Structures Maintenance and Investigations.

State Contract Plans

When planned for sufficiently in advance, bridge plans can include provisions for approved public utility facilities to be installed during or after construction. The installation may be made by the owner or, by separate agreement, included in the State contract. This should be coordinated with the District Utility Engineer. In any case, an encroachment permit is required when installed.

Requirements (in addition to standard utility requirements)

- Location
  - In cases where the intersecting road crosses the highway on an overcrossing structure, the State will make provisions, when possible, to carry such facilities in the structure.
  - When permitted, encroachments shall preferably be located under the shoulder or sidewalk area (i.e., between exterior and first interior girder).
  - Encroachments should not be exposed to view. No installation shall be permitted on the exterior of a bridge unless completely enclosed so as to appear to be an integral part of the bridge. Exceptions are rare and must be approved by the Office of Structures Maintenance and Investigations.
  - On very wide structures that have an expansion joint in the median, provisions can usually be made to locate an encroachment between the two interior girders in the median.
- Encroachment Application
  - Must include an adequate sketch of installation and pertinent details, including:
    a) location on bridge,
    b) method of attachment to bridge,
    c) type of material transported,
    d) weight per foot of facility including load, encasement, etc.,
    e) maximum operating pressure,
    f) wall thickness of pipe.
  - Gas pipelines require additional information as per PUC General Orders.

- Pipelines carrying highly volatile fluids must show the location of the nearest automatic shut-off valves each side of the structure. Shut-off valves are required to be within a reasonable distance of the structure.

- Pipelines conveying water, sewage and low volatile fluids shall include evidence of compliance with corrosion control requirements of the FHWA and State PUC

- Electrical and communication conduits must also include maximum voltage and description of carrier conduit.

• Encasement

- Pipelines carrying gas or other highly volatile fluids:

  a) Must be encased in a steel sleeve throughout the structure. Encasement should extend a minimum of 5' beyond backface of abutment or in the case of structures with approach slabs, a minimum of 5' beyond the limits of approach slab.
  b) The sleeve must have a diameter at least four inches larger than the largest outside diameter of pipe.
  c) The space between the pipe and encasement must be effectively vented at each end so that no pressure buildup is possible. It is not permissible to vent into the earth or backfill material because of explosion possibilities. Sniffer pipes should be installed at the end of and on the outside of wingwalls.
  d) Exception – in rare instances it may be impractical (e.g., curvature, space) to provide encasement. Subject to Office of Structures Maintenance and Investigations' approval, the wall thickness of the carrier pipe must then be increased.

- Pipelines conveying water, sewage and low volatile fluids:

  a) If pipeline passes over a freeway, primary road or railroad, it must be encased. Other locations where encasement is required will be determined by the Office of Structures Maintenance and Investigations.
  b) A box girder cell may be considered the encasement if:
     1) access is available for the full length of the pipeline in the structure;
     2) the carrier is metal pipe; and
     3) provisions are made to adequately drain the cell in the event of pipe rupture. Special attention should be given to pipelines under pressure.
  c) The encasement shall extend at least 20 feet beyond the back face of abutment and a minimum of five feet beyond the backfill area such that any leakage in the pipe will not flow under or around the bridge abutments, or in the case of structures with approach slabs, a minimum of 5' beyond the limits of approach slab.
  d) Exception – in rare instances it may be impractical (e.g., curvature, space) to provide encasement. In lieu of encasement, other safeguards may be required.

- Electrical and communication lines shall be encased in rigid metallic conduits or other approved material. All electrical conduits shall be grounded in accordance with Electrical Safety Orders of Cal-OSHA.

- When encasement is not otherwise required, the needs of the encroachment should be considered if there is impaired clearance or proximity to unusual hazards (e.g., high tension power lines, flood channels, subsiding ground).

• Access to encroachment facilities in:

- Undercrossing structures or bridges over waterways is prohibited from the surface of the traveled way. Manholes in the shoulder area or sidewalk area may be authorized.

- Overcrossing structures, by means of manholes, may be authorized where necessary and feasible

• Basic Specifications

- Exposed pipes or sleeves shall be painted or covered with an approved coating. Such coating shall match the color of the structure and shall be maintained to the satisfaction of Caltrans. The cost of repainting or protection of the encroachment shall be borne by the permittee.

- High pressure systems:

  a) Shall conform to American Pipeline Institute (API) specifications and to ASTM specifications covering sizes and types not covered by API.
  b) If operating pressures are over 200 psi:
     1) Wall thickness shall conform to PUC General Orders.
     2) For gas pipelines, maximum allowable hoop stresses shall be 40 percent of the specified minimum yield strength .
     3) Maximum allowable hoop stresses for other high volatile fluids shall conform to ANSI, except that the maximum hoop stress under the "test pressure" shall not exceed 90% of the yield strength.
     4) A pressure test at 1.5 times maximum operating pressure will be conducted for 24 hours.
     5) Radiographic inspection shall be made for *all* field welds.

- Sewer lines will not be steel pipe unless corrosion protective measures are provided.

- Electrical and communication conduits shall conform to PUC General Orders. High voltage lines will not be permitted where the lives of the traveling public could be endangered.

- Other pipelines may be steel, cast iron, ductile iron or other approved material.

Attachment

- Vehicular Tunnels And Tubes

  – No public utility or other encroachment shall be permitted within a vehicular tunnel or tube. An existing encroachment in an existing tunnel or tube that is incorporated in a new highway improvement may be allowed to remain under special circumstances with the approval of the Longitudinal Encroachment Committee. Whenever feasible, the encroachment should be relocated.

ENCROACHMENTS ON BRIDGES

Based on *Manual of Encroachment Permits*

All encroachments on bridges must be reviewed by the Office of Structures Maintenance and Investigations.

State Contract Plans

When planned for sufficiently in advance, bridge plans can include provisions for approved public utility facilities to be installed during or after construction. The installation may be made by the owner or, by separate agreement, included in the State contract. This should be coordinated with the District Utility Engineer. In any case, an encroachment permit is required when installed.

Requirements (in addition to standard utility requirements)

Location

- In cases where the intersecting road crosses the highway on an overcrossing structure, the State will make provisions, when possible, to carry such facilities in the structure.
- When permitted, encroachments shall preferably be located under the shoulder or sidewalk area (i.e., between exterior and first interior girder).
- Encroachments should not be exposed to view. No installation shall be permitted on the exterior of a bridge unless completely enclosed so as to appear to be an integral part of the bridge. Exceptions are rare and must be approved by the Office of Structures Maintenance and Investigations.
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  e) maximum operating pressure,
  f) wall thickness of pipe.
- Gas pipelines require additional information as per PUC General Orders.
- Pipelines carrying highly volatile fluids must show the location of the nearest automatic shut-off valves each side of the structure. Shut-off valves are required to be within a reasonable distance of the structure.
- Pipelines conveying water, sewage and low volatile fluids shall include evidence of compliance with corrosion control requirements of the FHWA and State PUC.
- Electrical and communication conduits must also include maximum voltage and description of carrier conduit.

Encasement

- Pipelines carrying gas or other highly volatile fluids:
  a) Must be encased in a steel sleeve throughout the structure. Encasement should extend a minimum of 1.5 m beyond backface of abutment or in the case of structures with approach slabs, a minimum of 1.5 m beyond the limits of approach slab.
  b) The sleeve must have a diameter at least 100 mm larger than the largest outside diameter of pipe.
  c) The space between the pipe and encasement must be effectively vented at each end so that no pressure buildup is possible. It is not permissible to vent into the earth or backfill material because of explosion possibilities. Sniffer pipes should be installed at the end of and on the outside of wingwalls.
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  a) Shall conform to American Pipeline Institute (API) specifications and to ASTM specifications covering sizes and types not covered by API.
  b) If operating pressures are over 1.38 MPa:
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